

THE ADVANTAGES OF USING A NEGATIVE PRESSURE RESPIRATOR HOOD

Guidance On The Use Of Hoods With Chemical Protective Respirators And Chemical Protective Suits

**Produced by the Chemical Weapons Improved Response Program
Of the U.S. Army Soldier and Biological Chemical Command
Aberdeen Proving Ground, Maryland**

Negative pressure respirators, sometimes called masks, often come with protective hoods. These hoods attach to the respirator, generally around the outside of the face seal, and cover the head and the upper shoulders. Figure 1 shows an example of an MCU2P negative pressure respirator. Figure 2 shows an M40 respirator, with a respirator hood.



Figure 1. MCU2P Respirator Without Respirator Hood

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Figure 2. M40 Respirator With Respirator Hood

Negative pressure respirator hoods primarily are designed to provide chemical agent liquid splash protection over the head and upper shoulders. They often serve to create an interface between the respirator and a Level C chemical protective suit, although they do not form a vapor-tight interface. Respirator hoods are not designed to offer additional respiratory protection. Since respirator hoods were designed for liquid splash protection (as an interface to the protective suit), respiratory protection offered by a negative pressure respirator normally is measured without a respirator hood. Tests are not normally conducted to measure changes in respiratory protection, when the respirator is worn with and without the respirator hood. Thus when a negative pressure respirator is worn without a Level C protective suit, such as for escape purposes, there is little advantage in wearing a respirator hood with the respirator. A hood would be worn with a negative pressure respirator, without other protective clothing, only in situations where liquid splash protection was needed specifically about the head, neck, and upper shoulders.

An example of a police patrol officer wearing a Millennium negative pressure respirator by itself, without a respirator hood, is shown in Figure 3.



Figure 3. Millennium Respirator Without Respirator Hood

Chemical agent vapors create hazards through skin exposure as well as through inhalation exposure. Although a respiratory exposure tends to be more hazardous than the same amount of skin exposure, some chemical agents produce significant hazards by skin exposure, and these hazards must not be ignored. Even though respirator hoods do not form vapor-tight seals with protective clothing ensembles, respirator hoods often provide the only protective barrier against vapor exposure about the head and neck, outside of the face seal of the respirator.

The U.S. Army Soldier and Biological Chemical Command (SBCCOM) conducts tests to measure the protection that chemical protective ensembles provide against vapor exposure of the skin. These tests are called Man-In-Simulant Tests (MIST). Although a negative pressure respirator hood does not significantly increase respiratory protection, it does protect the skin about the head and neck from vapor exposure. This is particularly true when the respirator hood is worn in combination with a suit hood. Our testing shows that when the respirator hood is tucked down into the neck opening of the protective suit, and the protective suit hood is worn over the respirator hood, protection against vapor exposure is significantly increased. We call this hood configuration double-hooded. The double-hooded configuration significantly reduces vapor exposure about the head, neck, ears, and backs of the cheeks. In these body regions, the skin absorbs many vapors faster than it does in many other body regions. Therefore, vapor exposures about the head present greater hazards than vapor exposures in many other regions of the body. Wearing a suit hood over the respirator hood, with the respirator hood tucked down into the neck opening of the protective suit, provides significantly better protection of the overall individual against vapor exposures.

A test subject wearing a single respirator hood is illustrated on the next page, in Figure 4, which shows a respirator hood worn with a Millennium negative pressure respirator. Although not visible, a chemical protective undergarment is being worn beneath a standard duty uniform. Only the single, respirator hood protects the head and neck. In Figure 4, the respirator hood is tucked under the ballistic protection vest,

providing better protection than would be achieved if the hood were worn over the ballistic protection vest.

Following Figure 4, Figure 5 shows a police officer wearing the respirator hood underneath the suit hood. Of course, the respirator hood cannot be seen in Figure 5; it is hidden beneath the suit hood. Figure 5 illustrates the double-hooded configuration. In the double hooded configuration, the respirator hood is worn under the suit hood.



Figure 4. Saratoga® Chemical Protective Undergarment Worn with Standard Duty Uniform, Negative Pressure Respirator and Respirator Hood; No Suit Hood is Worn



Figure 5. Tyvek ® F Suit with Worn with Respirator, Respirator Hood, and Suit Hood (Double Hooded)

SBCCOM conducted MIST tests, in which the respirator hood was worn under the Tyvek F suit hood (double-hooded), as shown in Figure 5. These tests were conducted with the Millennium respirator and respirator hood. These tests were conducted during the Maryland State Police (MSP) Special Weapons and Tactics

(SWAT) Team protective suit MIST testing. Although the double-hooded Tyvek F suit configuration offered significant protection about the head and neck, results for the Tyvek F suit were not included with results for other SWAT suit tests because the SWAT Teams determined that the suit was too noisy to be used in a tactical situation where stealth was required. Test results for the other protective systems tested and stay-times associated with the ensembles are available in the SBCCOM report, "Guidelines for Use of Personal Protective Equipment by Law Enforcement Personnel During a Terrorist Chemical Agent Incident", June 2001.

A copy of this report can be obtained at the following SBCCOM Homeland Defense Web Site, which is:

: <http://www2.sbccom.army.mil/hld/>.

Earlier MIST testing with the Tyvek F suit was conducted during a test series that looked at chemical protective equipment for patrol officers, who may be securing the perimeter of a chemical agent release. Results of this testing is documented in the SBCCOM report, "Chemical Protective Clothing for Law Enforcement Patrol Officers and Emergency Medical Services when Responding to Terrorism with Chemical Weapons", November 1999. This report can also be found at the SBCCOM Homeland Defense Web Site.

During the earlier series of tests, the Tyvek F ensemble was worn without a respirator hood. Only the suit hood was worn over the head. MIST test results show that, in the double-hooded configuration, the Tyvek F ensemble gives a Physiological Protective Dosage Factor of 103, while the earlier testing of the same Tyvek F suit worn without the respirator hood gave a Physiological Protective Dosage Factor of 42. MIST testing shows that when the Tyvek F ensemble is worn in the double-hood configuration, it provides approximately twice as much protection against vapor hazards to the skin as when it is worn with only a single hood (the suit hood). The neck and cheeks are very sensitive to chemical vapor exposure, since they readily absorb many chemical agent vapors, and it is easy to understand that a double-hooded Level C ensemble significantly improves skin protection.

Figure 6 shows a clear example of how the neck can be exposed to chemical vapors if a suit hood is worn without a respirator hood.



Figure 6. Neck Leakage Around Suit Hood When Suit and Respirator are Worn Without a Respirator Hood

Most Level C suits come with attached hoods that provide additional protection to the head and neck area. However, suit hoods do not form a vapor-tight seal around the respirator and face. As Figure 6 shows, sometimes a direct opening can occur. Frequently, skin about the neck, under the chin, is directly exposed, as illustrated in Figure 6. This poor closure can permit direct vapor exposure of some skin surfaces, as well as leakage into the hood, causing vapor exposure about the head, neck, and cheeks. Since many chemical agent vapor present hazards through absorption into the skin, it is important that complete body protection be provided. The suit hood should not be considered a replacement for a respirator hood. When used together in the double-hooded configuration, both hoods to provide a more effective interface between the protective respirator and the suit.

We recommend that a negative pressure respirator hood always be worn with Level C chemical protective suit ensembles, even if the suit has an attached hood. When used in the double-hooded configuration, two protective hoods are better than one for skin protection about the neck and cheeks. As Figure 6 visually illustrates, the respirator hood is needed to provide a protective interface to seal leakage between the respirator and the suit hood.